PSE&G

Public Service Electric and Gas Company P.O. Box 236 Hancocks Bridge, New Jersey 08038

Nuclear Department

August 2, 1983

Director of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
7920 Norfolk Avenue
Bethesda, Maryland 20014

Attention: Mr. Steven A. Varga, Chief
Operating Reactors Branch 1
Division of Licensing

Gentlemen:

UPDATED FINAL SAFETY ANALYSIS REPORT
NO. 1 AND 2 UNITS
SALEM GENERATING STATION
DOCKET NOS. 50-272 AND 50-311

PSE&G hereby transmits, pursuant to the requirements of 10CFR 50.71(e), Revision 1 of its Updated Final Safety Analysis Report for Salem Generating Station, No. 1 and 2 Units. Revision 1 presents changes made to the facility since the submission of Revision 0 of the Updated Final Safety Analysis Report on July 15, 1982. Information and analyses submitted to the NRC or prepared pursuant to NRC request since then are also incorporated. Changes made under the provisions of 10CFR 50.59, but not previously submitted to the NRC are identified in the Monthly Operating Reports which are submitted in accordance with Facility Operating License requirements.

This transmittal consists of one (1) original and twelve (12) copies.

Very truly yours,

EALiden

E. A. Liden
Manager - Nuclear
Licensing and Regulation

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Enclosures

CC: Mr. Donald C. Fischer
Licensing Project Manager

Mr. Leif Norrholm
Senior Resident Inspector

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of)
)
Public Service Electric and Gas) Docket Nos. 50-272
Company, et. al.) and 50-311
)
(Salem Nuclear Generating)
Station, Units 1 and 2))

CERTIFICATION

I, Richard A. Uderitz, Vice President - Nuclear, a duly authorized officer of Public Service Electric & Gas Company, licensed in the captioned proceeding, certify pursuant to 10 CFR 50.71(e) that the information presented in Revision 1 to the Updated Final Safety Analysis Report for Salem Nuclear Generating Station, Units 1 and 2, presents changes made since the submission of Revision 0 of the Updated Final Safety Analysis Report on July 15, 1982 necessary to reflect information and analyses submitted to the Nuclear Regulatory Commission ("Commission") or prepared pursuant to Commission requirement.

Vice President - Nuclear
Public Service Electric and
Gas Company

Subscribed and sworn to before me
this 2nd day of August, 1983

Donna G. Hitchner
Notary

My Commission expires on March 24, 1987

50-272 Superseded Per Revision 1 to UFSAR Dtd 8/2/83 #8308100025
Revised 8/15/83

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APPENDIX A TMI LESSONS LEARNED

1.3 IDENTIFICATION OF CONTRACTORS

The Salem Generating Station was designed and constructed by PSE&G. Westinghouse Electric Corporation designed and furnished the nuclear steam supply equipment and systems including the fuel assemblies.

PSE&G contracted United Engineers and Constructors Inc. of Philadelphia, Pennsylvania, to supervise field erection. PSE&G also engaged several consultants to provide technical assistance in various areas. These consultants are listed below.

Consultant	Program
Southwest Research Institute, San Antonio, Texas	Quality Control
S. M. Stoller Corporation, New York, New York	Reactor Core and Nuclear Fuel Cycle
Smith - Singer Meteorologists, Inc., Amityville, Long Island, New York	Meteorology
Dames and Moore, Cranford, New Jersey	Geology, Hydrology, Seismology
Pritchard - Carpenter, Consultants, Coral Gables, Florida	Hydrology
Radiation Management Corporation, Philadelphia, Pennsylvania	Radiation Monitoring, Emergency Planning
Ichthyological Associates, Middletown, Delaware	Marine Ecology
Porter-Gertz, Consultants, Inc., Ardmore, Pennsylvania	Radiation Monitoring Emergency Planning

2.0 SITE CHARACTERISTICS

2.1 GEOGRAPHY AND DEMOGRAPHY

2.1.1 SITE LOCATION

The Salem site is located on the southern part of Artifical Island on the east bank of the Delaware River in Lower Alloways Creek Township, Salem County, New Jersey. The point of intersection of the centerlines of the two containment buildings and the auxiliary building is located at Latitude 30° 27' 46" North and Longitude 75° 32' 08" West. The Universal Transverse Mercator coordinates of the reactor site are 4,368,100 m N and 454,070 m E, Zone 18. While called Artificial Island, the site is actually connected to the mainland of New Jersey by a strip of tideland formed by hydraulic fill from dredging operations on the Delaware River by the U. S. Army Corps of Engineers. The site is 15 miles south of the Delaware Memorial Bridge, 18 miles south of Wilmington, Delaware, 30 miles southwest of Philadelphia, Pennsylvania, and 7-1/2 miles southwest of Salem, New Jersey. The location of the site with respect to major cities in the northeast is shown on Figure 2.1-1 and 2.1-2.

Salem Nuclear Generating Station is located on a 700 acre site which is owned by PSE&G Access to the site is achieved by a road (constructed by PSE&G that connects with Alloways Creek Neck Road, about 2-1/2 miles east of the site. The location of the site with respect to the surrounding area is shown on Figure 2.1-3, a U. S. Geological Survey map. An aerial photograph is presented in Figure 2.1-4.

2.1.2 SITE DESCRIPTION

The location of the site boundary and significant plant features is shown in Figure 2.1-5.

The site exclusion area is defined as follows:

Land

The land exclusion area is defined as that area bounded by the property line as shown on Figure 2.1-5. This land is owned by and under the control of Public Service Electric and Gas. The minimum distance between the reactors and the exclusion area boundary (property line is 1270) meters.

Water

The water portion of the exclusion area is defined as that area bounded by the locus of points 1270 meters from the containment buildings of either No. 1 or No. 2 Units and also falling within the Delaware River. The 1270 meters is consistent with the minimum land exclusion area distance.

Discussion of the exclusion of people, property and river traffic from that portion of the exclusion area which extends over the river is included as part of the detailed Emergency Plan, Section 13.3.

2.1.2.1 Exclusion Area Control

PSE&G owns and has control of the 700 acre land area that comprises the exclusion area. Control of the water portion of the exclusion area is described in Section 13.3, Emergency Plan.

2.3 METEOROLOGY

2.3.1 REGIONAL CLIMATOLOGY

2.3.1.1 Data Sources

Data sources are listed in the references provided at the end of this section.

2.3.1.2 General Climate

Based on the Koeppen climatic classification system, the region intersects two climatic zones. They are humid continental and humid subtropical. Both zones have characteristics of warm summers and mild winters.[1] Summer maximum average temperatures are near 80 degrees Fahrenheit and the coldest month is January having an average daily temperature of approximately 32 degrees Fahrenheit. Examining a thirty year mean of precipitation amounts for Wilmington, Delaware National Weather Service (NWS) station shows that the most rainfall occurs in the summer months, followed by Spring, Fall, and Winter.[2]

The area of southern New Jersey is frequented by Polar Canadian air masses in the Fall and Winter and occasionally invaded by Artic Canadian air late in Winter. During the Spring and Summer, the dominant air mass is Maritime Tropical.[3]

2.3.1.2.1 Precipitation

The frequency of precipitation events such as rain, snow, ice storms, thunderstorms, and hail are tabulated in Tables 2.3-1, 2.3-2, and 2.3-3. The data in Table 2.3-1 were obtained from the Revised Uniform Summary of Surface Weather Observations, Dover (Delaware) Air Force Base, 1942-1965. The data presented in Tables 2.3-2 and 2.3-3 were obtained from Philadelphia International Airport and Trenton Airport, respectively.

2.3.1.2.2 Humidity, Winds

Humidity annually averages 70%.[4] Prevailing winds on a monthly average during the Winter (December to March) are from a Northwest direction with a range of speeds from 9-13 mph. Average monthly winds for the Spring and Summer months (April to August) are from a southerly to southwesterly direction at speeds ranging from 7-10 mph. Winds during the Fall are predominantly from the West-Southwest veering to a West-Northwest direction by December. The average wind speeds increase as the season progresses.[5]

2.3.1.3 Severe Weather

The terrain is open and extremely flat which favors a vigorous wind flow. While the area is almost certain to experience hurricane force winds frequently, there is no reason to anticipate fastest mile velocity, reaching 100 miles per, more than once in 100 years. Table 2.3-4 lists the distribution of peak winds for Philadelphia International Airport based on a twenty-five year record. The tornado frequency in this area is reassuringly low; a few small funnels have been observed in Southeastern Pennsylvania and Southern New Jersey, but it is unlikely that any tornado would affect the site itself more than once in 4300 years.

2.3.2 LOCAL METEOROLOGY

1. Figure 2.3-1 shows the different stations, that collect meteorological records. Figures 2.3-2 and 2.3-3 are two-year wind roses derived from Artificial Island wind data using all hours and only hours with a stable stability, respectively. The wind direction is randomly distributed when stable atmospheric conditions occur, whereas using all hours of data shows a Northwest wind direction peak.

2.3.3 ONSITE METEOROLOGICAL MEASUREMENTS PROGRAM

METEOROLOGICAL DATA COLLECTION PROGRAM

In order to arrive at atmospheric dispersion factors for use in calculating radiological exposures from both low level normal releases and accidental releases, an extensive data collection program was undertaken as the site. This data collection program is described in detail in the following paragraphs. The present meteorological monitoring program is in conformance with the recommendations of Regulatory Guide 1.23.

2.3.3.1 Preoperational Data Collection Program

Data became available from the 300 ft meteorological tower located on Artificial Island in June of 1969. The official preoperational data collection program was terminated at the end of May 1971. The tower was positioned just north of the actual plant site in Figure 2.3-1.

The actual location was 2700 feet north of Unit 2 at a latitude of 39 degrees 28 minutes 13 seconds north, and a longitude of 75 degrees, 32 minutes 12 seconds west.

A detailed representation of the meteorological facility is not necessary because of the simplicity of the terrain. The tower data used in this study is primarily that from the 33 and 300-foot levels, although some data were obtained at the intermediate 150-foot elevation. The wind instrumentation consisted of Aerovanes, and the temperature-difference measurements were obtained from aspirated resistance thermometers. The usual precipitation, humidity and solar radiation are on record if they are ever needed for general environmental applications.

2.3.3.1.1 Data Summaries and Turbulence Classifications

The record of temperature and all other data extends from June 1969. Data are being obtained continuously. A monthly temperature distribution is presented in Table 2.3-5.

Table 2.3-6 shows monthly summaries of precipitation in inches for June 1969 through November 1970. Included with this summary is a range of maximum hourly rates.

Table 2.3-7 lists the monthly percentages of hours with fog in three-hour intervals. The months October through March have the largest percentage of lag during the hours 0600 to 0800. During April through September, the largest percentage occurred between the hours 0300 to 0500.

Stability

Alternative techniques of estimating the turbulence usually involve one of two methods: approximating it from a combination of lapse rate and wind speed measurements, or from the fluctuations of a standard wind instrument such as an Aerovane. We believe the latter to be more representative of the typical problems, and accordingly this presentation is largely based on wind direction range and gustiness data. The lapse rate classification has been used, however, and some of the data are summarized in the report. In this instance, the two techniques are in good agreement.

Turbulence Classifications

The system used for defining the turbulence is that developed originally by Singer and Smith[6] and widely applied in both nuclear and fossil power plant evaluations. The classification is depicted in Figure 2.3-4, where Classes I and II represent unstable conditions.

Class III is the overcast stormy situation, and Class IV is the stable, inversion flow pattern.

In the PSAR the distribution of turbulence classifications obtained from the Delaware City site ten miles NNW of Salem was presented as probably typical of the dispersion regimes. In Table 2.3-8 the new Salem data (300-foot level) are compared with the earlier summary from Delaware City, and the agreement is very good despite the fact that the information was obtained in different years. The only notable difference is that Salem showed a more marked tendency toward the neutral Class III turbulence than did Delaware City. This abberation may be real, but it is more likely that the water tower on which the Delaware City instrument was located produced some what broader and more turbulent direction traces than the clean installation at Salem. In any case, the difference has no great significance in the dispersion evaluation.

At both sites, the distributions seem quite normal for open, mid-latitude locations. The Class II turbulence dominates the distributions, accounting for approximately 60% of all hours, and the stable cases are found in roughly 25% of the remainder. We had anticipated a noticeable increase in the frequency of Class IV conditions during the late spring and early summer at Salem, because it is directly exposed to over-water flow which might be stable, but apparently the combination of infrequent winds from the 130-160° sector and the relatively mild bay temperatures did not produce the expected increase.

Lapse Rates

In Table 2.3-9, the distribution of lapse rates over the year is shown. These data agree well within the indications of the turbulence classification, in that 24% of the hours appear to be stable, 14% neutral and the remainder unstable.

Another indication that the water influence is fairly small at this site is that the diurnal variation of the lapse rate in June (Figure 2.3-5) does not show any tendency toward stability in the afternoon hours, and, in fact, is quite similar to the December (Figure 2.3-6) pattern.

Relation Between Lapse Rates and Turbulence Classes

As a final comparison between turbulence classes and the lapse rate data, Table 2.3-10 is presented. In it, it is clear that the two methods of estimating turbulence are compatible at this site. The vast majority of Class I and Class II turbulence hours are associated with unstable lapse rates, and the Class IV hours are primarily inversion periods as they ought to be.

The distributions of lapse rates, winds and turbulence classes already presented are adequate to define the diffusion meteorology of this site as quite normal and uncomplicated, but it is important to translate the data as accurately as possible into the dispersion parameters actually used in numerical evaluations. Since the experience with the bi-directional wind vane was typically unsuccessful, the measurement of hourly wind direction range was evaluated and used for estimates of θ. These data, separated according to turbulence class, are given for the entire period of observation in Table 2.3-11, and it is apparent that the wind fluctuations at this site are very nearly identical to those at Brookhaven National Laboratory[7] where the turbulence classification was originally developed. It therefore is reasonable to utilize the diffusion parameters developed at that site[8] in this study.

One further point is important, and that is to be sure that diffusion with south-southeast winds from the open waters of Delaware Bay is not significantly different from that occurring with other wind directions. Table 2.3-12 is a replica of Table 2.3-11, except that only south-southeast winds are represented. Obviously there is no difference.

over water for three or four miles before reaching populated areas, and therefore, is not a valid estimate of the problem.

The Salem site is substantially identical to many others in that one may anticipate a very stable dispersion situation existing with a 1 m/sec wind speed from almost any wind direction at a time of an accident. Such a situation might maintain for an hour or two, but since the site is subjected to brisk winds under any stability condition, one would anticipate that a 2 m/sec wind would be minimum estimate for the succeeding 24 hours, even if stable conditions continued. For the remainder of the 30 days following the postulated accident, one must review the accumulated meteorological data for reasonable probabilities, and essentially three different combinations appear. The month of June, 1969, is clearly the least favorable of the entire set of observed data with the following combination of conditions:

Wind Direction:	130°
Class I Frequency:	0.3%
Class II Frequency:	7.0%
Class III Frequency:	2.2%
Class IV Frequency:	3.7%

This wind direction, however, carries the effluent competely over water for several miles, and cannot be considered limiting except in terms of producing the highest potential value at relatively great distances. Discarding this case as unrealistic, two other candidates appear in the record, both of which have onshore winds. The first is December, 1969, in which over 15% of the Class II cases came from 300° accompanied by 1% of the Class IV cases. The other situation was found in August, 1969, where the Class IV condition had a high frequency of occurrence (3.1%), but Class II occurred in only 1.5% of the hours from the same direction.

These cases have been analyzed, and it is apparent that the dominance of the Class IV situation is such that one must postulate the least favorable case as an extension that the following extreme set of conditions represents the least favorable.

Wind Direction:	240°	
0-2 hours:	Class IV,	1 m/sec. wind
2-24 hours:	Class IV,	2 m/sec. wind
1-5 days:	Class II,	4 m/sec. 5%
	Class III,	5 m/sec. 2%
	Class IV,	2.5 m/sec. 6%
6-30 days:	Class II,	4 m/sec. 3%
	Class III,	5 m/sec. 1%
	Class IV,	2.5 m/sec. 4%

This computation is in our judgement a conceivable sequence of conditions, and it has been translated into X/Q values which appear below:

LEAST FAVORABLE DIFFUSION SEQUENCE

0-30 DAYS

(X/Q)

Distance (km)	0-2 Hrs	3-24 Hrs	1-5 Days	6-30
1.5	4.0×10^{-4}	2.0×10^{-4}	3.2×10^{-4}	1.9×10^{-6}
2.5	1.9×10^{-4}	9.3×10^{-5}	1.2×10^{-6}	7.2×10^{-7}

5.0	7.0×10^{-5}	3.5×10^{-5}	3.7×10^{-7}	2.1×10^{-7}
10.0	2.9×10^{-5}	1.5×10^{-5}	1.2×10^{-7}	6.7×10^{-8}

It was stated that from the purely meteorological standpoint, the least favorable set of conditions that occurred was for a wind direction of 130°. X/Q values for 0-30 days only, for distances of about 5.6 km (the distance to the Delaware shore) and 8 km (the radius of the low population zone) are 1.35×10^{-7} sec/m and 7.3×10^{-8} sec/m, respectively.

2.3.5 LONG-TERM DIFFUSION ESTIMATE

2.3.5.1 Objective

The objective is to provide realistic estimates of annual average off-site atmospheric dilution factors based on site meteorological data.

2.3.5.2 Calculations

Annual X/Q values for sixteen - 22 1/2° arcs at sixty distances are presented in Tables 2.3-17 through 2.3-20. The meteorological input data used was the two-year period, June 1969 through May 1971. X/Q estimates are based on the procedures presented in U. S. NRC Regulatory Guide 1.111. These values were submitted in July 1976 as part of the Appendix I, 10CFR50 submittal to the NRC.

References For Section 2.3

1. Chritchfield, Howard J.: General Climatology, Englewood Cliffs, N.J. (Prentice Hall Inc.) pp. 148-151, 1966.

2. Wilmington, Delaware Local Climatological Data, U.S. Dept. of Commerce, 1980 ed.

3. Critchfield, Howard J.: General Climatology, Englewood Cliffs, N.J. (Prentice Hall Inc.) pp. 148-151, 1966.

4. U.S. Dept. of Commerce: Weather Atlas of the United States, pp. 170-175, June 1968.

5. U.S. Dept. of Commerce: Weather Atlas of the United States, pp. 228-234, June 1968.

6. Singer, I. A. and M. E. Smith: Relation of Gustiness to other Meteorological Parameters, Jour. Meteor., 10: (2), pp. 121-126, 1953.

7. Singer, I. A. John A. Frizzola and M. E. Smith: A Simplified Method of Estimating Atmospheric Diffusion Parameters, APCA Journ., v. 16, #11. Nov. 1966.

8. Singer, I. A. and M. E. Smith: Atmospheric Dispersion at Brookhaven National Laboratory, Int. Jour. of Air and Water Pollution, 10: pp. 125-135, 1966.

The nearest residences to the site are about three miles distant. Their water supply is obtained from shallow driven wells, or, in some cases, is carried in along with other provisions.

Most water wells inventoried were located three to four miles from the site. The nearest wells in Delaware are more than three miles from the site and were not canvassed since it is not believed that they would not be affected by a change in the groundwater regimen at the site because of the intervening Delaware Estuary.

Site Groundwater

The subsurface soils and groundwater conditions at the site are consisent with the regional picture. The upper soils at the site are dredged fills which were placed at about the turn of the century by the United States Army Corps of Engineers. The fill material apparently came from the channel of the Delaware River. Information obtained from test borings drilled on the site indicates the thickness of the hydraulic fill is generally less than 10 feet. Dames and Moore's report on Foundation Studies for Hope Creek Generating Station states:

> "At the surface, the hydraulic fill extends to a depth of about 30 feet below the present ground surface. The fill deposit is of man-made origin, having been deposited on the site as a result of channel maintenance in nearby areas..."

We have been calling the 30' upper layer as hydraulic fill all through the project work, including the correspondence with NRC.

Dames and Moore's site subsurface section designated the upper 30' as hydraulic fill also. It is of the same designation in ES (page 2-9).

The fill material is composed of a heterogeneous mixture of silt, silty clay, fine sand and organic material. Four soil percolation tests were conducted on these materials to measure the absorption rate of the surficial soil. These tests were conducted in accordance with the U. S. Corps of Engineers procedures. The absorption rate ranged from one to four gallons per day per square foot. The average rate was 2.7 gallons per day per square foot. Water levels are approximately at the level of the adjacent estuary waters.

Below the hydraulic fill, a grey sandy and gravelly material, which formally comprised of the bed of Delaware River was found. This layer varies in thickness from 2 to 5 feet and is composed of fine-to-coarse sand, a little fine-to-coarse gravel, and trace of silk. The permeability of the sand, based upon particle size analyses, ranges from about 50 to 150 gallons per day per square foot. The clay facies is essentially impermeable. The lateral extent of this sand member is unknown, but it appears to exist in most of the site area. It is hydraulically connected with the Delaware Estuary, and water levels in this formation change in response to tidal variations. Water levels in this formation are essentially horizontal and although changes in response to tides do occur, the horizontal component of groundwater movement is small.

The Kirkwood Formation of Miocene Age underlies the Quaternary soil and extends to about 70 feet in depth. It consists of gray silty clay and is an aquitard. Permeability values are less than 50 gallons per day per square foot.

The Vincentown Formation is about 45 to 75 feet thick and is encountered at a depth of about 70 feet. It consists of a fine to medium grained sand with occasional gravel and is separated from the Quaternary soils by about 35 feet of impermeable silty clay of the Kirkwood Formation. Grain size analyses of this sand indicate a permeability of about 200 gallons per day per square foot. Water levels in this formation are essentially horizontal with an artesian pressure head just slightly lower than the surficial groundwater table. The horizontal component of

3. Components of the Reactor Coolant System are examined to identify and to classify missiles according to size, shape and kinetic energy for purposes of anlayzing their effects.

The Petry formula as described in 3.5.3 is used to check the missile penetration. The energy approach is used to determine the equivalent statis load from the missile impact.

3.5.2 TORNADO MISSILES

Category I structures including the Reactor Containments, Auxiliary Building and Fuel Handling Buildings are designed to withstand tornado missiles. These structures are also designed such that under the impact of the most damaging tornado missile, they will not create a secondary missile of enough mass or velocity to penetrate any adjacent Category I structure.

3.5.2.1 Critical Missiles Selected for Evaluation

For tornado generated missiles, a wooden utility pole has been used as the critical object for pentration analysis. The pole is 40 feet long, 12 inches in diameter, weighing 50 pound per cubic foot and traveling in a vertical or horizontal direction at 150 MPH.

In addition, the exterior walls of the safety related plant structures, which have a minimum thickness of 18 inches, have been evaluated against the following two missiles:

1. Steel rod, 1 in. diameter, 3 ft. long, weight 8 lbs, traveling at 0.6 of total tornado velocity.

2. Utility pole, 13 1/2 in. diameter, 35 ft. long, weight 1490 lbs, traveling at 0.4 of total tornado velocity.

A passenger car missile is also used in the evaluation.

3.5.2.2 Missile Protection Methods

The minimum thickness of the concrete barriers used to resist tornado missiles is 18 inches. The requirements for local penetration, scabbing/spalling, as well as the overall structural response were considered in the design. The minimum concrete strength (f'c) at 28 days is 3500 psi. The minimum reinforcement in a missile barrier utilizes No. 5 bars at 9 inch centers on each face. Penetration depth has been checked by the Modified Petry's formula as given in 3.5.2 to assure the walls, roof slabs and dome will not be perforated by the tornado missiles.

The penetration into a reinforced concrete slab has been calculated to be approximately 10 inches, much less than the thickness of the wall or roof. This will not cause any damage inside the Category I structure.

Results of calculation indicated that the 1 inch diameter steel rod missile and the 13-1/2 inches diameter utility pole missile will neither penetrate nor perforate the exterior walls of the safety related plant structures which have a minimum thickness of 18 inches.

Results of an evaluation also indicated that the safety related plant structures are less vulnerable to a passenger car missile because of its lower velocity and larger impact area.

Concrete barriers were designed elastically under tornado missile load, therefore, the ductility factor was one.

3.5.2.3 Safety Assurance Against Tornado Missile Induced Damages

Category I systems outside the Category I buildings that may be damaged by tornado or secondary missiles are the refueling water storage and

The buoyancy effect of ground water was included in the assessment of the sliding and overturning potential of all Category I structures. The buoyancy effect will reduce the dead weight and thus reduce the factors of safety against sliding and overturning. To include the buoyancy effect in assessing the sliding and overturning potential is the more conservative and correct approach.

The safety against sliding, overturning and flotation for all Category I structures under all loading combinations are within the limits set by the SRP 3.8.5.

Masonry Walls

For the loading criteria for non-structural masonry walls see Section 3.8.4.6.1.

3.8.4.4 Design and Analysis Procedures

The Category I structures have been designed based on ACI 318-63 "Working Stress Design" for normal operating load plus Operating Basis Earthquake; and "Ultimate Strength Design" for normal loads plus design Basis Earthquake or Tornado. In the working stress design under Operating Basis Earthquake the allowable stresses are one-third above the normal applicable code working stresses. Wind stresses are found to be less critical then those generated for an Operating Basis Earthquake. Load factors of unity have been used in the ultimate design under Design Basis Earthquake or tornado loading. The stress of reinforcing steel under ultimate strength design has been kept under 0.9Fy. The capacity reduction factor "ϕ" as described in 3.8.1.4.1 for concrete stress is applicable for all Category I structures. A coefficient "k" of 0.85 for 3500 psi concrete has been used in addition to "ϕ" for equivalent rectangular concrete stress distribution.

Steel members inside the Category I structures are designed in accordance with the AISC Manual of Steel Construction (Sixth Edition or later edition, as applicable).

Seismic design criteria are described in Section 3.7. Tornado and tornado generated missile design is described in 3.3.2 and 3.5.2

Two independent seismic analyses similar to those for the containment building have been performed for the auxiliary building and fuel handling building. Conservative results have been utilized for the building design. The time history computer analysis calculations are kept on file with Public Service.

This information has also been provided in the "Conrad Associates: design report (Reference 2A).

The loading combinations used for Category I (seismic) steel structures other than containment are as follows:

1. Working stress design

   a. D + L + I + H
      Allowable stresses in accordance with AISC Manual of Steel Construction

   b. D + L + I + H + E
      Allowble stresses are one-third above the normal allowable stresses

2. Ultimate strength design

a. D + L + I + H + E'

b. D + L + I + H + T

The stress in the ultimate strength design has been kept under 0.9 Fy

where:

D - Dead load
L - Live load
I - Impact load where moving load is present
H - Thermal load
E - Operating Basis Earthquake
E' - Design Basis Earthquake
T - Tornado loading

Protection against tornado wind loads and tornado missiles is discussed in Sections 3.3.2 and 3.5.2.

Protection against turbine disc rupture and missile generation is described in Section 3.5.4.

Masonry Walls

For analysis of non-structural masonry walls see Section 3.8.4.6.1.

3.8.4.5 Materials, Quality Control and Special Construction Techniques

3.8.4.5.1 Masonry Walls

There is no masonry block construction in the Containment and Fuel Handling Building. In the Auxiliary Building and penetration area removable block walls are reinforced with steel bars and also anchored to the slab. These provisions are used to prevent the wall from collapsing under earthquake forces; however, they are not considered as major shear walls to carry the lateral forces for the building.

All of the masonry walls that have been installed within (and between) Category I Structures and adjacent to Category I tanks have been re-evaluated for seismic loadings and are found to be within the following 2 groups:

1. Those walls whose collapse would endanger or effect in any way the safety of any Category I Structure.

2. Those walls whose collapse would not effect the safety of any Category I Structure.

A structural analysis has been performed on each of the walls whose collapse would effect any of the Category I Structures to determine the shear and bending stresses to assess their margin of safety.

For the re-evaluation and analysis, the masonry wall field testing and inspection, the design for the corrective action, the Structural Steel reinforcing and the drawings, see "Report on Re-evaluation of Masonry Walls", dated Nov. 28, 1980 which was submitted to the NRC on December 10, 1980.

3.11 ENVIRONMENTAL DESIGN OF MECHANICAL AND ELECTRICAL EQUIPMENT

The electrical portions of the engineered safety features and the reactor protection systems are designed to remain functional in all abnormal environments anticipated under normal, test, and design basis accident conditions. This section presents information on the design basis and qualification verifications for mechanical and electrical equipment for these systems. Section 3.7 presents the seismic design requirements and Section 3.10 presents the seismic qualification of electrical equipment.

On May 23, 1980, the NRC Commissions issued memorandum and order CLI-80-21 which stated that the DOR guidelines and NUREG-0588 set the requirements that Licensees and Applicants must meet regarding the environmental qualification of safety-related electrical equipment to satisfy 10CFR50, Appendix A, General Design Criteria (GDC) 4. This evaluation was conducted and the required information is detailed in the docketed "Salem Generating Station, Environmental Qualification Review, Volumes 1a2 and subsequent revisions. The original response was transmitted to the NRC on December 12, 1980. Subsequent revisions were transmitted on January 16, 1980 and February 9, 1981 the Salem Units 1 a 2 information was evaluated and Safety Evaluation Reports (SER) were issued by the NRC on May 28, 1981 (Unit 2) and June 8, 1981 (Unit 1). PSE G responded to the SERs as required on September 1, 1981 (Unit 2) and September 2, 1981 (Unit 1). These actions by PSE G adequately meet the requirements set forth by the Memorandum and Order CLI-80-21 regarding environmental qualification of safety-related electrical equipment.

3.11.1 EQUIPMENT IDENTIFICATION AND ENVIRONMENTAL CONDITIONS

3.11.1.1 Equipment Identification

A list of Class 1E equipment that is located in a harsh environment and must operate to mitigate the effects of an accident and maintain the plant in a safe condition can be found on the report titled Salem Generating Station, Environmental Qualification Review Report. Volumes 1&2, 12/1/80 and subsequent revisions.

This list, identifies pieces of equipment according to service, manufacturer, location, environment and qualification.

3.11.1.2 Accident Conditions

Plant environments in various plant zones for an array of accident conditions is also contained in the "Salem Generating Station, Environmental Qualification Review Report," Volumes 1 2, 12/1/80 and subsequent revisions

3.11.1.3 Normal Operating Environment

Temperature in the control room and adjoining equipment room is maintained for personal comfort at 70°F ± 15°. Protective equipment in this space is designed to operate within design tolerance over this temperature range. Design specifications for this equipment specify no loss of protective function over the temperature range from 40°F to 110°F. Thus there is a wide margin between design limits and the normal operating environment for control room equipment.

Within containment, the normal operating temperature for protective equipment except out-of-core neutron detectors will be maintained below 120°F. Protective instrumentation is designed for continuous operation within design tolerance in this environment. Out-of-core neutron